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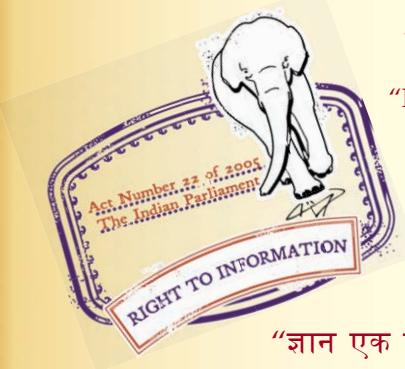
“Step Out From the Old to the New”

IS 6034 (1989): Insulating oil conditioning plants [MED 17: Chemical Engineering Plants and Related Equipment]

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Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”





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*Indian Standard*

**INSULATING OIL CONDITIONING  
PLANTS—SPECIFICATION**

*(First Revision)*

भारतीय मानक

ऊष्मा रोधन तेल अनुकूलन संयंत्र — विशिष्ट  
( पहला पुनरीक्षण )

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**BUREAU OF INDIAN STANDARDS**  
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## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 24 October 1989, after the draft finalized by the Chemical Engineering Plants and Related Equipment Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

Insulating oil conditioning plants are used for the purification of transformer and switch oils by removal of particulate contaminants, drying and deaeration of the oil. If the oil is heavily aged, mere purification, dehydration and degassification will not restore the ageing properties and regeneration will have to be additionally resorted to. The oil conditioning plant can also be used for drying transformers prior to putting them into service. Should the insulation of the transformer be aged, again a regeneration exercise has to be undertaken.

For regeneration of both oil and insulation, the basic oil conditioning plant will have to be supplemented with a regeneration column containing Fuller's Earth or Activated Alumina.

Insulating oil for transformer and switchgear are subject to deterioration or contamination in storage, handling, or service. The impurities contaminating the insulating oil essentially consist of:

- a) Moisture dissolved and free,
- b) Dissolved gases or air,
- c) Sludge as a result of oxidation,
- d) Suspended dust,
- e) Drum scale, rust, or presence of other material, and
- f) Adventitious solids, such as carbon products formed due to *arc*ing.

These impurities not only reduce the di-electric strength but also induce a considerable ageing of the insulators. They also cause overheating by settling on heat transfer surfaces.

A periodic and effective removal of these impurities becomes necessary to ensure:

- a) Safety of the transformer,
- b) Increased longevity, and
- c) Prevention of fast deterioration of the insulating oil.

The standard, first published in 1971, has been revised to incorporate the latest developments in filtering systems being used in the industry.

*Indian Standard*

# INSULATING OIL CONDITIONING PLANTS—SPECIFICATION

## ( First Revision )

### 1 SCOPE

1.1 This standard prescribes the rated output and other requirements of the insulating oil conditioning plants used for purification, drying and deaeration of transformer and switchgear oil keeping in view the extreme variation of climatic conditions.

### 2 REFERENCES

IS No.	Title
IS 325 : 1978	Three-phase induction motors (fourth revision)
IS 335 : 1983	New insulating oils (third revision)
IS 6792 : 1972	Method for determination of electric strength of insulating oils

### 3 CONSTRUCTIONAL REQUIREMENTS

3.1 The filter and its components shall be constructed with adequate strength and rigidity to withstand normal conditions of handling, transport and usage. There shall be no sharp edges or corners liable to cause injury during use. The design of the plant shall be such as to permit removal of any defective part and its easy replacement.

3.2 All parts, which (due to their positions or nature of operations) are likely to cause accidents, shall be properly guarded during their normal use.

3.3 Tubes and wires, connected to resiliently-mounted components shall be properly fixed, so that vibrations are reduced to a minimum and fatigue failure is avoided.

### 4 MATERIALS

4.1 Materials used in the construction of the filters shall comply with Indian Standards wherever applicable. They shall be free from defects which are liable to cause undue deterioration or failure. Under normal conditions of use, the materials used shall not shrink or warp.

### 5 OIL CONDITIONING SYSTEM

5.1 Essentially the insulating oil conditioning system will consist of a heater with heating

elements, filter cartridges or edge pack type of filter, vacuum chamber, vacuum pump, inlet feed pump, outlet discharge pump, valves and other accessories.

#### 5.2 Heater

The heating of the oil is carried out in the heater vessel with such a design which allows for high heat transfer efficiency while eliminating localised overheating due to hot pockets. Necessary baffles shall be provided in the heater vessel for this purpose. Heater elements provided in the heater shall be divided into a number of independently controlled banks and as the oil temperature rises, it shall be ensured that fewer heaters are in operation. This will ensure safe progressive heating of the oil. The recommended operating temperature of oil is 60 to 70°C. The heater capacity shall be sufficient to heat up the oil from the ambient temperature to the required operating temperature.

#### 5.3 Filter

The filter shall consist of filter cartridges or filter paper packs as filter medium. The filter shall be compact in size. It shall be suitably sized to handle the required flow rate and remove all solid impurities down to 5 μm which is normally sufficient to upgrade the breakdown voltage to the required value.

5.3.1 The filter cartridges shall be non-hygroscopic and throwaway type. The construction feature of the filter cartridge shall ensure large dust holding capacity within a compact volume. The filter cartridge shall be capable of maintaining a constant micron rating throughout its life.

5.3.2 The filter paper packs shall be made from specially prepared paper and treated to ensure that presence of moisture in the oil does not affect the paper packs. Provision shall be made for quick and thorough cleaning of the filter pack by means of compressed air in the reverse direction of normal oil flow direction. The filter packs shall be easily removable for maintenance and replacement.

#### 5.4 Degassing Chamber

Provision shall be made for dehydration and degassification of the filtered oil in the vacuum

chamber. The vacuum chamber shall be of such design as to ensure maximum spread, retention and exposure of oil to the vacuum. The chamber may be single or multistage type and shall be designed to ensure the final oil parameters for moisture content and gas content with relatively less stringent levels of vacuum.

The vacuum level and the capacity of the vacuum pump are dependent on the efficiency of degassing and the same would depend on the specific design.

### 5.5 Vacuum Pump

The vacuum pump provided shall have adequate capacity to maintain the required level of vacuum in the vacuum chamber to attain the specified final oil parameters.

### 5.6 Oil Inlet Pump

The oil inlet pump shall be of positive displacement type with a built-in relief valve to take care of accidental pressure increase. This pump shall have a suction head of 4.5 metres of oil and maintain a constant output. In cases, where suction of oil from an evacuated transformer/tank is envisaged, it is recommended that an additional feeder pump is provided.

### 5.7 Discharge Pump

The discharge pump shall be able to suck the oil from the vacuum chamber which is under vacuum and discharge it at the required flow-rate.

5.8 A visual indicator together with necessary controlling device for regulating the level of oil in the vacuum chamber shall be provided. It is preferable to monitor the oil level in the degassing chamber using an optical device which will be free of any mechanical wear and tear and suitable for sensing and controlling both foam and oil level.

5.9 Thermostat shall be provided for controlling temperature of the oil. Two dial thermometers shall be provided, one at oil inlet to gear pump and the other at the outlet of the heater/inlet of the filter. A suitable vacuum gauge shall be provided in the suction line connecting the degassing chamber to the vacuum pump to read the vacuum in the chamber and a compound gauge shall be provided at filter inlet to indicate choking of filters.

5.10 Necessary interlocks shall be provided between the inlet feed pump and heater in such a way that unless the inlet pump is 'ON' heater cannot be switched 'ON'.

5.11 Pressure relief valve of suitable rating shall be provided in the heater vessel to take care of

any accidental pressure increase in the heater vessel.

5.12 A control board to house all required electrical accessories like contactors, pilot lamps, switches etc, shall be provided.

### 5.13 Motors

Electric motors shall conform to IS 325 : 1978. The motor shall be adequately protected against overload.

5.14 The whole unit may be stationary or mobile as required. In case of filters for out door use, all components of the plant shall be suitably housed in a weather-proof enclosure. The casing shall be provided with large doors for easy access to the various components.

5.15 The plants required for towing over roads shall be mounted on a pneumatic tyred trailer with springs, towbar and automatic mechanical over-run brakes.

5.16 The nitrile lined rubber oil hose pipes supplied along with the plant shall be suitable for handling hot transformer oil and meet the functional requirements. A minimum of one pair of 10 metre long hose pipe with required end fittings shall be supplied along with the plant.

## 6 GUARANTEES

### 6.1 Warranty

The plant shall be guaranteed by the manufacturer or supplier against defects in materials and workmanship under normal use and service for a period of one year from the date of despatch.

The above guarantee is not applicable for filter cartridges and electrical items, as the life of these items depends on various factors which are beyond the control of the manufacturer or supplier.

The life of the filter cartridge, for instance, is dependent on initial contamination of the oil and extent of use and this cannot be quantified. The life of electrical control gear depends on the consistency of the power supply and should the voltage variation at site be beyond the permissible limits, the life would be unpredictable.

### 6.2 Performance Guarantee

The manufacturer or supplier shall guarantee the ability of the oil conditioning plant to upgrade the quality of the oil from the initial specified conditions or as per specified conditions in IS 335 : 1983 for the required parameters to the values as follows. The sample of the

conditioned oil shall be collected at the sampling valve of the plant.

*Oil Parameters before Conditioning:*

Breakdown voltage	20 kV*
Moisture content	50 ppm
Gas content	10 percent by volume

*Oil Parameters after 3-5 passes*

Approx Classification of Transformer as per kV Rating	Break-down* Voltage (kV)	Moisture Content (ppm)	Gas Content (Percentage Volume)
400 kV and above	70	2	0.05
220 kV-400 kV	65	3	0.1
Below 220 kV	60	10	1.0

**7 MARKING**

**7.1** Each plant shall have the following information marked on a name plate in a permanent

\*Measured as per IS 6792 : 1972.

and legible manner in a location where it is accessible and easily visible after installation:

- Manufacturer's and/or supplier's identification;
- Capacity of the unit;
- Serial number of the plant to provide adequate identification; and
- Electric supply details, such as voltage of the supply circuit, normal operating current and power requirements of the plant.

**8 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER**

**8.1** Manufacturer or supplier shall furnish the following data relating to the plant:

- Rated output of the plant in litres per hour,
- Minimum suction head in metres at rated output,
- Full-load heater rating in kilo Watts,
- Power requirements of the motor used, and
- Quantity of oil in litres required for the filling.

**8.2** At the time of supply, the manufacturer or the supplier shall also provide the operation and maintenance instruction manual together with flow diagram, wiring diagram and general assembly drawing.

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